

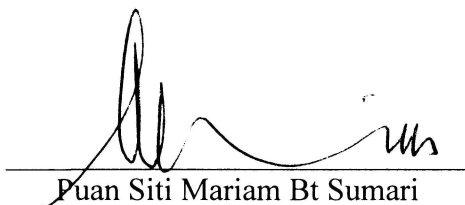
**THE CALCINATION EFFECT OF Mg-Al-NO<sub>3</sub> LAYERED DOUBLE  
HYDROXIDE ON REMOVAL OF REACTIVE DYES**

**SITI NADIAH BINTI ZULKAFLI**

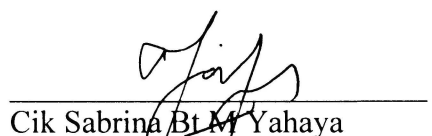
**Final Year Project Report Submitted in  
Partial Fulfilment of the Requirement for the  
Degree of Bachelor of Science (Hons.) Applied Chemistry  
in the Faculty of Applied Sciences  
Universiti Teknologi MARA**

**MAY 2010**


This Final Year Project Report entitled **“The Calcination Effect of  $\text{MgAlNO}_3$  Layered Double Hydroxide on Removal of Reactive Dyes”** was submitted by Siti Nadiah Binti Zulkafli, in partial fulfillment of the requirement for the Degree of Bachelor of Science (Hons.) Applied Chemistry, in the Faculty of Applied Sciences, and was approved by



Puan Siti Mariam Bt Sumari  
Supervisor  
B. Sc (Hons.) Environmental Technology  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor



Cik Sabrina Bt M Yahaya  
Project Coordinator  
B.Sc.(Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor



Dr. Siti Halimah Sarijo  
Head of Programme  
B.Sc.(Hons.) Applied Chemistry  
Faculty of Applied Sciences  
Universiti Teknologi MARA  
40450 Shah Alam  
Selangor

Date: 25 / 5 / 2010

## **ACKNOWLEDGEMENTS**

Assalamualaikum w.b.t,

Firstly in the name of Allah s.w.t, the Most Merciful and The Most Passionate, thankful of Allah for the strength given to me in completing my degree study.

First of all, I would like to thanks to University Teknologi Mara (UiTM) for giving me a chance to do the final year project that is useful for me to gain work experience.

Special thanks go to my parents, my father Zulkafli Hj A Bakar, and my mother Khatijah bt Sungip for their concern, financial support and patience.

I would like to express my sincere gratitude and warmest thanks to my supervisor, Pn Siti Mariam Sumari for his support, guidance, time, ideas and helps throughout this study.

A special appreciation goes research assistant, Cik Mazlin, the staff of environmental lab, biology lab, chemistry lab, En Rosmi, En Amri, En Adnan and En Khairul and for those who are involved directly and indirectly in assisting my study.

Last but not least, I would like to express my earnest gratitude and thanks to all my friends in AS225 and also in other course for those who participate and contribute for completing my thesis.

Thank you

Siti Nadiyah Zulkafli

## TABLE OF CONTENTS

	Page
<b>ACKNOWLEDGEMENTS</b>	iii
<b>TABLE OF CONTENTS</b>	iv
<b>LIST OF TABLES</b>	vi
<b>LIST OF FIGURES</b>	vii
<b>LIST OF ABBREVIATIONS</b>	viii
<b>ABSTRACT</b>	ix
<b>ABSTRAK</b>	x
 <b>CHAPTER 1 INTRODUCTION</b>	
1.1 Background and Problem Statement	1
1.2 Significance of study	5
1.3 Objectives of study	6
 <b>CHAPTER 2 LITERATURE REVIEW</b>	
2.1 Impacts of dye to the environment	7
2.2 Introduction to dyes	8
2.3 Methods of dye removal	11
2.4 Layered double hydroxide	14
2.5 Calcination	17
2.6 Principles of adsorption	18
2.7 Reactive Red Dye (RR120)	21
2.8 Reactive Orange Dye (RO16)	22
2.9 Reactive Black Dye (RB5)	23
 <b>CHAPTER 3 METHODOLOGY</b>	
3.1 Chemicals	24
3.2 Equipments	24
3.3 Synthesis of hydrotalcite ( $\text{MgAl}(\text{OH})_6$ ) by constant pH co-precipitation method	25
3.4 Characterization of LDH	
3.4.1 X-Ray Diffractometer (XRD)	26
3.4.2 Thermogravimetric Analysis (TGA)	26
3.4.2 Fourier Transform Infrared Spectroscopy (FTIR)	27
3.4.3 UV-visible spectrophotometer	27
3.5 Optimization studies	

## **ABSTRACT**

### **The Calcination Effect of Mg-Al-NO<sub>3</sub> Layered Double Hydroxide in the Removal of Reactive Dyes**

Adsorption techniques have been proven to be successful in removal of organic coloured compound in wastewater. Due to this technique, Layered Double Hydroxide (LDH) was newly synthesized as a replacement of activated carbon which is more expensive as well as difficult in the regeneration process. This Mg-Al-NO<sub>3</sub>-LDH was synthesized using co-precipitation method and has been calcined in two different temperatures in order to distinguish the adsorption efficiency in both calcinations temperature. The efficiency of calcined LDH (CLDH) was examined in the removal of reactive dyes. Thermogravimetric Analysis (TGA) was used to determine at which temperature the LDH can be calcined. In this experiment, the LDH was calcined at 400 °C and 600 °C. The XRD pattern shows that the intense and sharp peaks of d-spacing at 7.9 Å and interlayer spacing peak at 4.5 Å were destroyed as the LDH was calcined and the regeneration process occur as the adsorption of dyes takes place. The FTIR spectrum shows the disruption of peak as the LDH was calcined and the adsorption has shown to be occur as the functional groups of dyes appear in FTIR spectrum of CLDH. The effect of contact time shows 400 °C of calcinations LDH is more efficient than the CLDH 600 °C in the removal of three reactive dyes. Efficiency of adsorption increase as the contact time increase until it reaches its equilibrium.